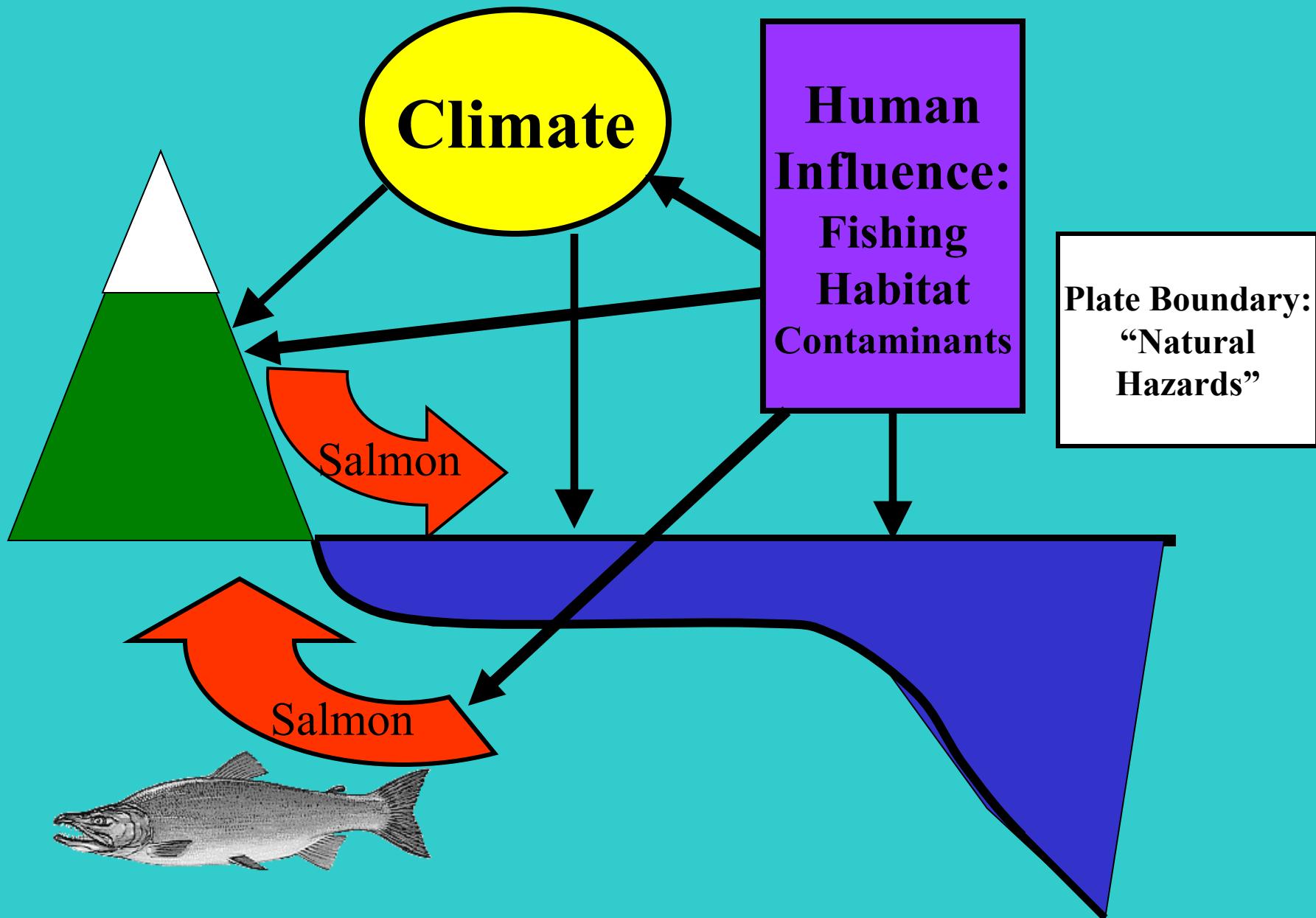


PAST TRENDS OF SALMON ABUNDANCE AND LAKE PRODUCTIVITY

Bruce Finney, Morgan Peterson, and Andy Krumhardt

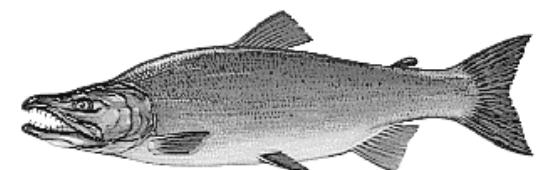
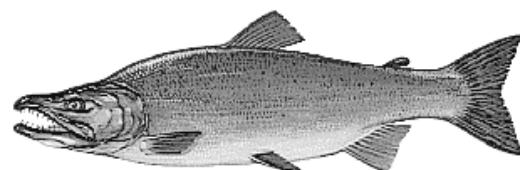
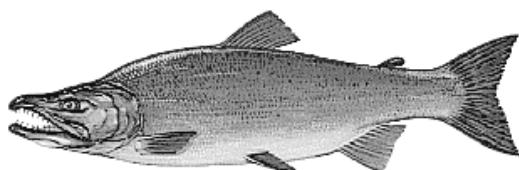
**School of Fisheries and Ocean Science
University of Alaska Fairbanks**

Pacific Salmon Environments (Present model)



The long-term perspective from Paleolimnology:

- What is the natural variability of sockeye salmon in these systems?
- Has climatic change and commercial fishing effected salmon runs?
- Are salmon-derived nutrients important to freshwater productivity?
- Are escapement goals compatible with the long-term perspective?
- Do different lake types respond differently to the same factors?
- How might future environmental change influence salmon productivity in these systems?



Paleolimnology Methods:

- Coring
- Dating
- Proxy analysis

Salmon abundance: $\delta^{15}\text{N}$

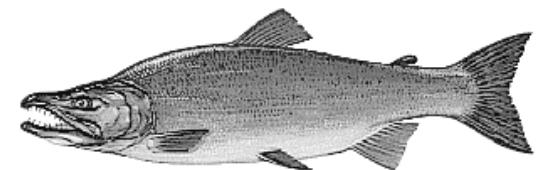
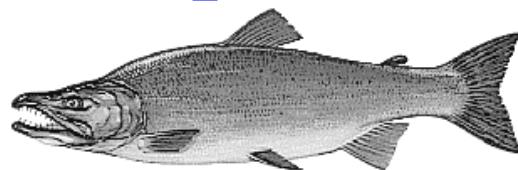
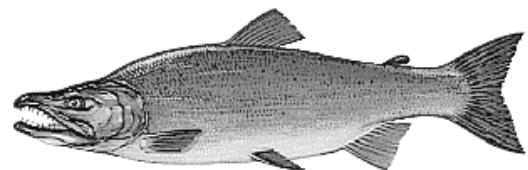
Lake productivity:

Opal

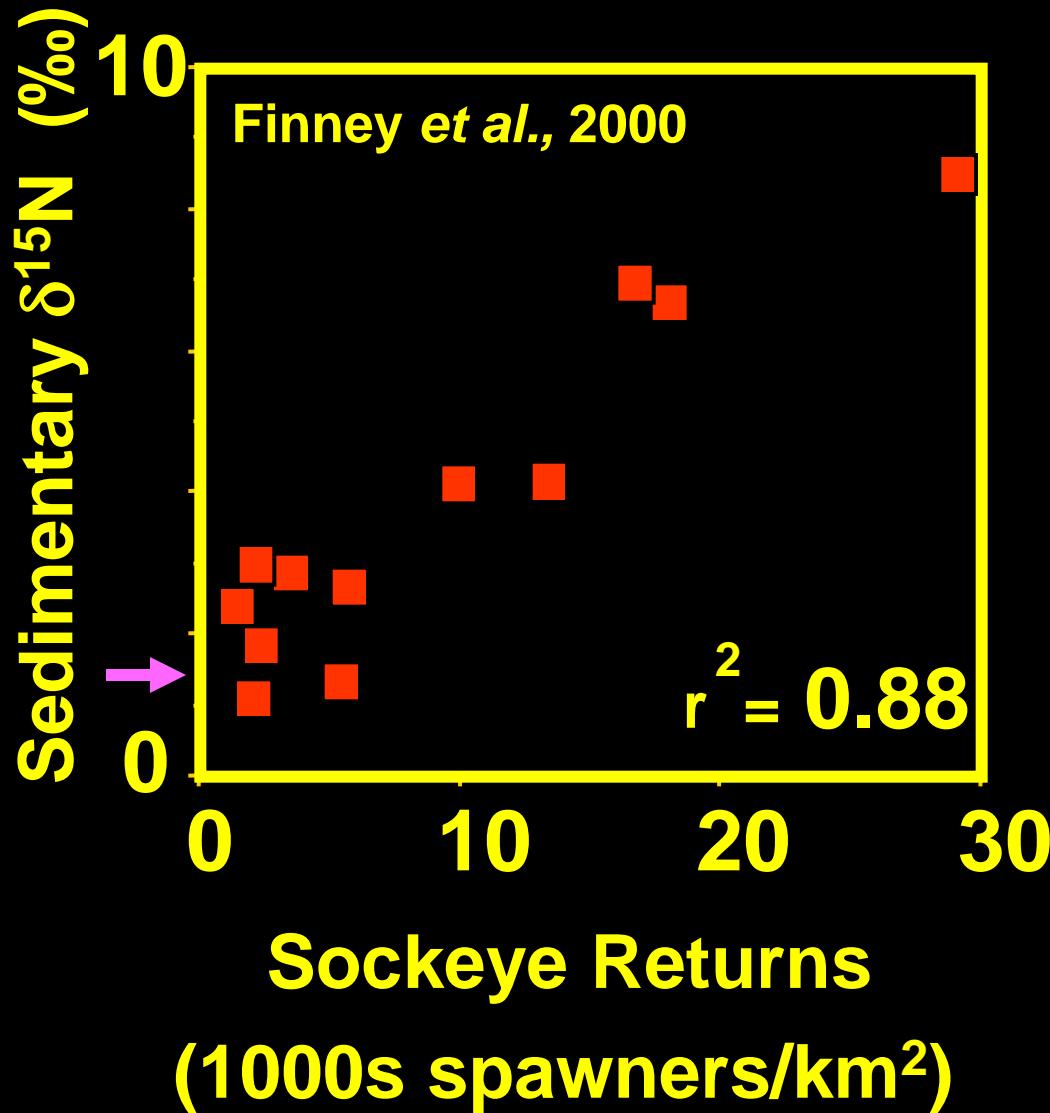
Organic C

$\delta^{13}\text{C}$

Diatom species



Stable Isotopes:



- Adult sockeye obtain > 99 % of biomass in ocean
- Adults transport marine nutrients to freshwater
- Salmon carcasses enriched in $\delta^{15}\text{N}$
- Sediment $\delta^{15}\text{N}$ tracer of past salmon abundance



Control (non-salmon) lakes are used to:

- Assess if other factors influence $\delta^{15}\text{N}$
- Determine climate and environmental histories

Objectives:

- Reconstruct past changes in salmon abundance. Time frame: last 500 years to end of the last ice age (c.a. 12,000 years BP).
- Determine past changes in lake primary productivity and nutrient status, for both salmon and barriered systems.
- Compare reconstructions to records of past changes in climate, volcanic eruptions, geomorphology and human impacts.
- Describe trends in sockeye abundance, assess recent escapement, and compare to trends for other Alaskan systems.
- Determine roles of lake primary productivity and salmon-derived nutrients in influencing sockeye production.

Study Lakes cored in 2003 and 2004, and focus research question.

Aniakchak National Park Unit

Surprise Lake: Sockeye salmon colonization date

Meshik Lake: Sockeye salmon colonization date

Katmai National Park Unit

Naknek Lake: Sockeye salmon population variability

Brooks Lake: Sockeye salmon population variability

Hammersley Lake: Sockeye salmon population variability

Murray Lake: Sockeye salmon population variability

JoJo Lake: Timing of isolation

Devil's Cove Lake: Timing of isolation

Klosterman Lake: Control

Pringle Lake: Control

Study Lakes (continued).

Alagnak National Park Unit:

Nonvianuk Lake: Sockeye salmon population variability

Lake Clark National Park Unit

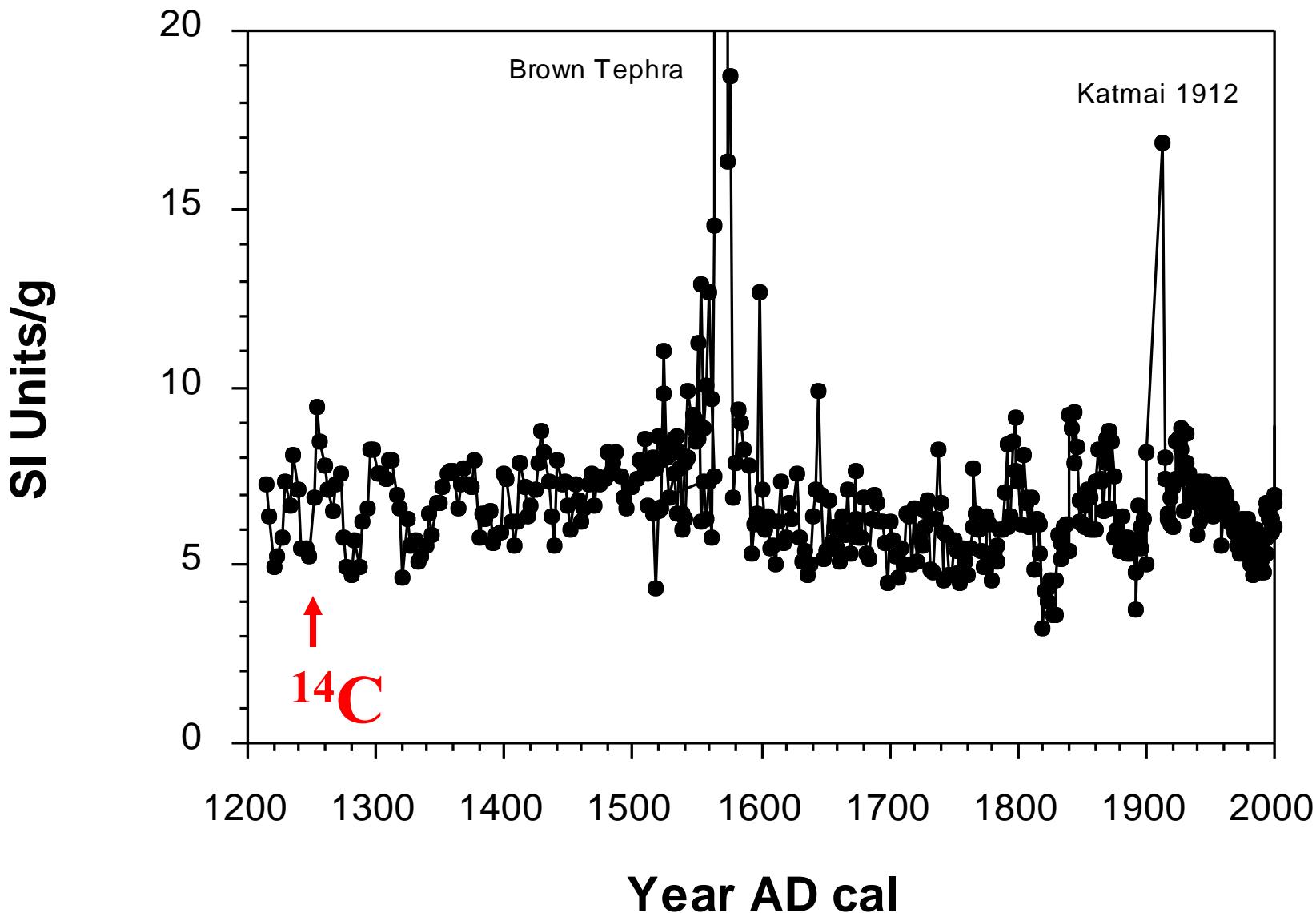
Crescent Lake: Sockeye salmon population variability

Kontrashibuna Lake: Control

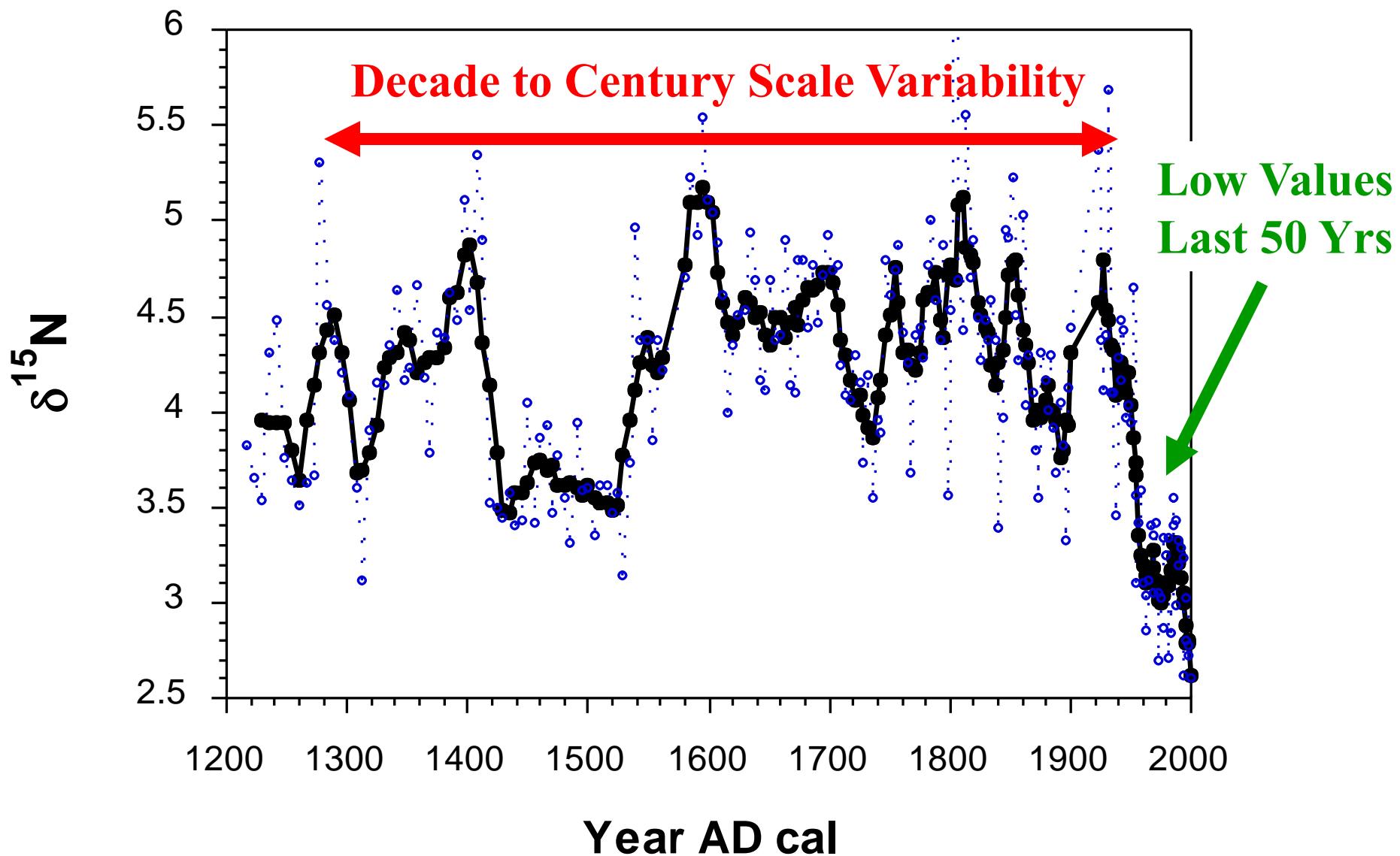
Highlights of research to date



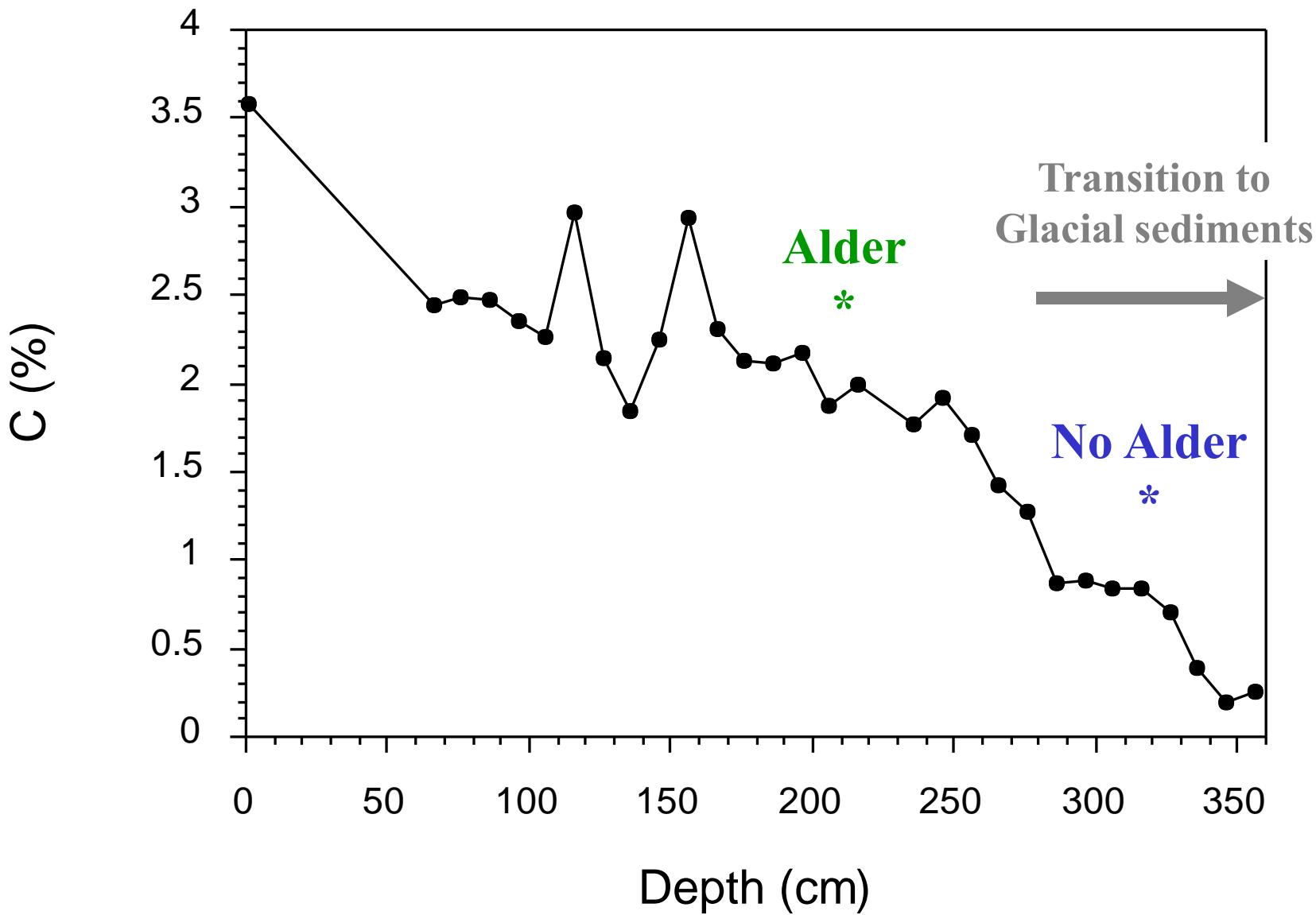
Naknek Lake Dating: \sim 800 year Record



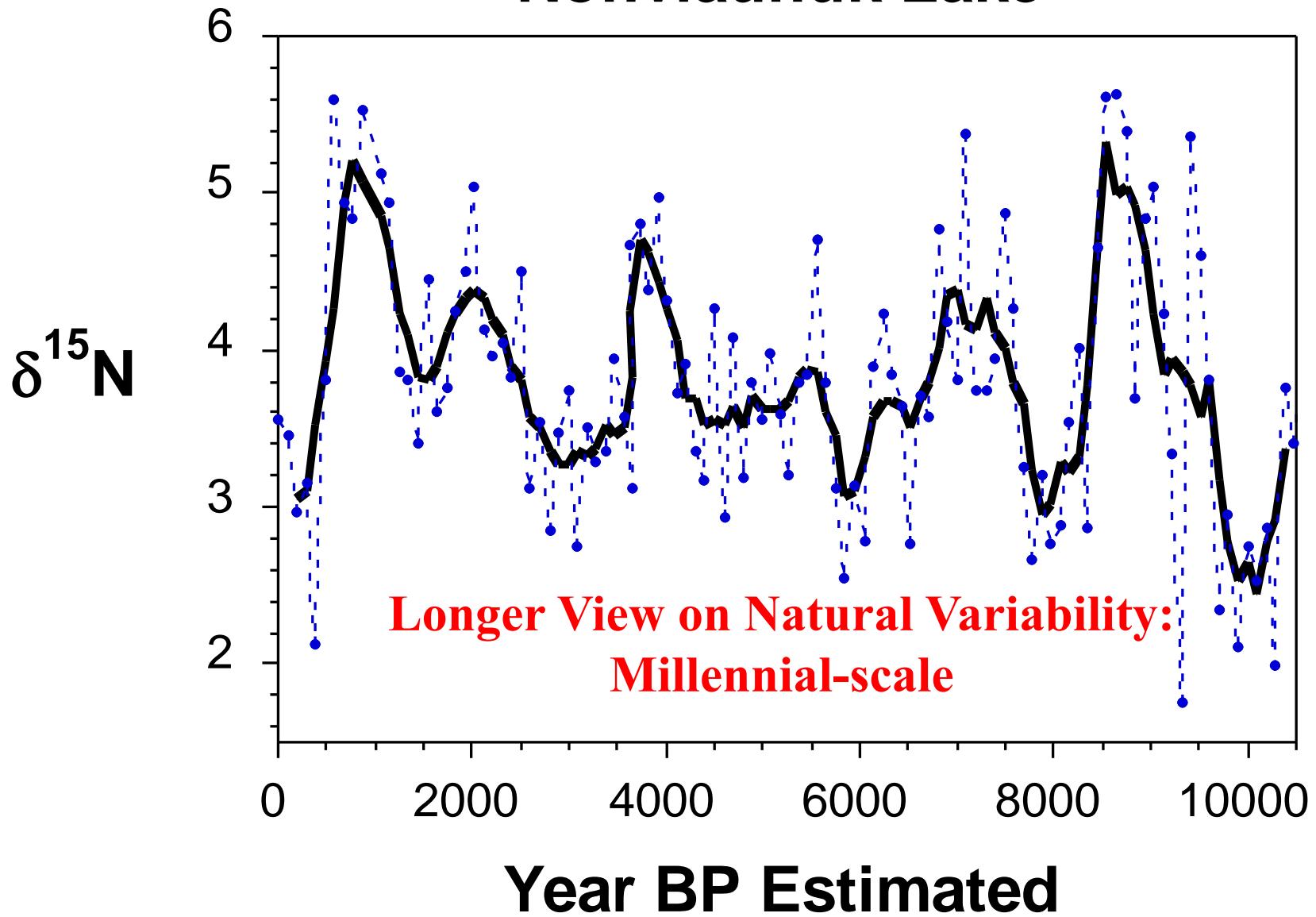
Naknek Lake



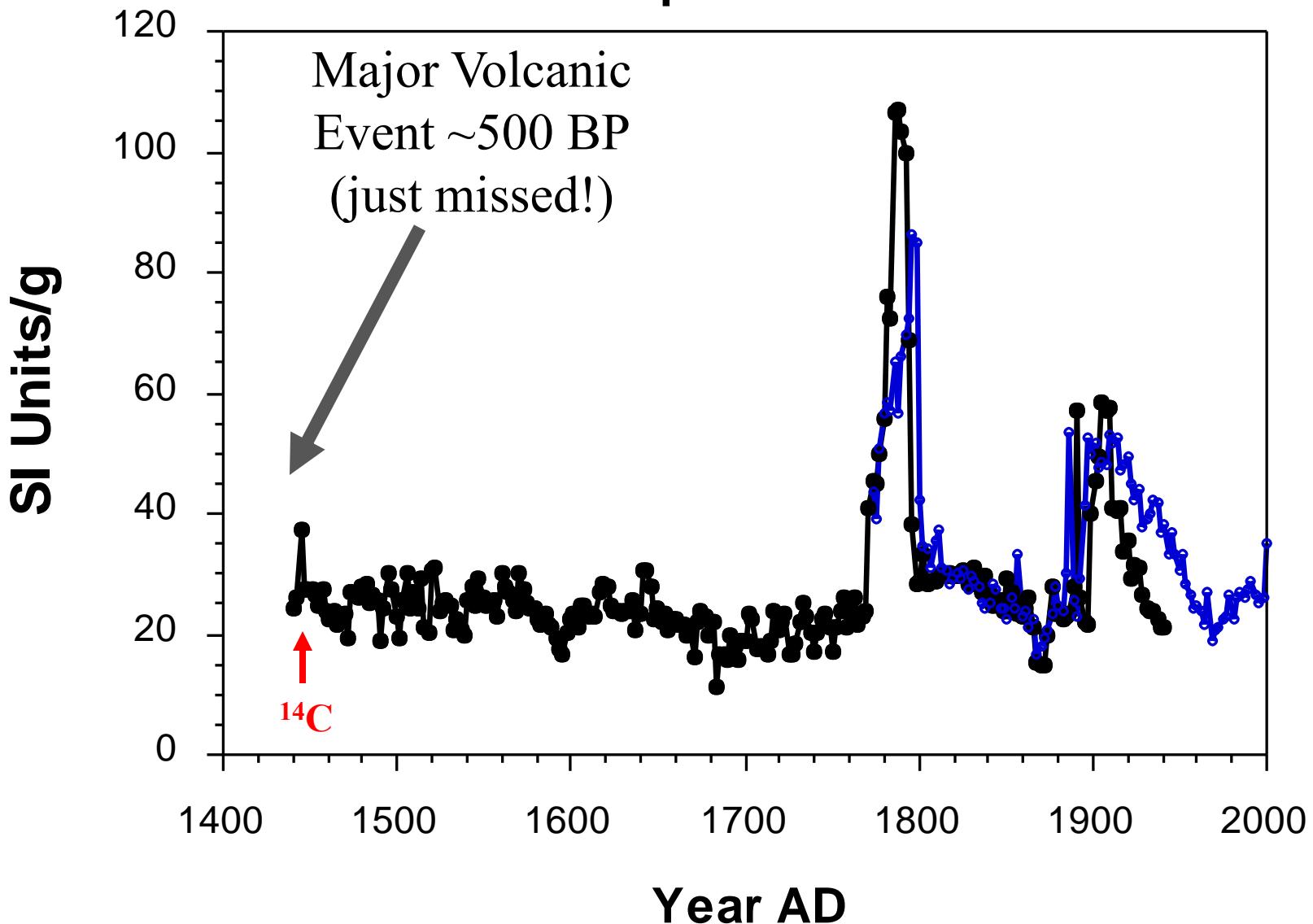
Nonvianuk Lake: Deglacial Transition - Old Record



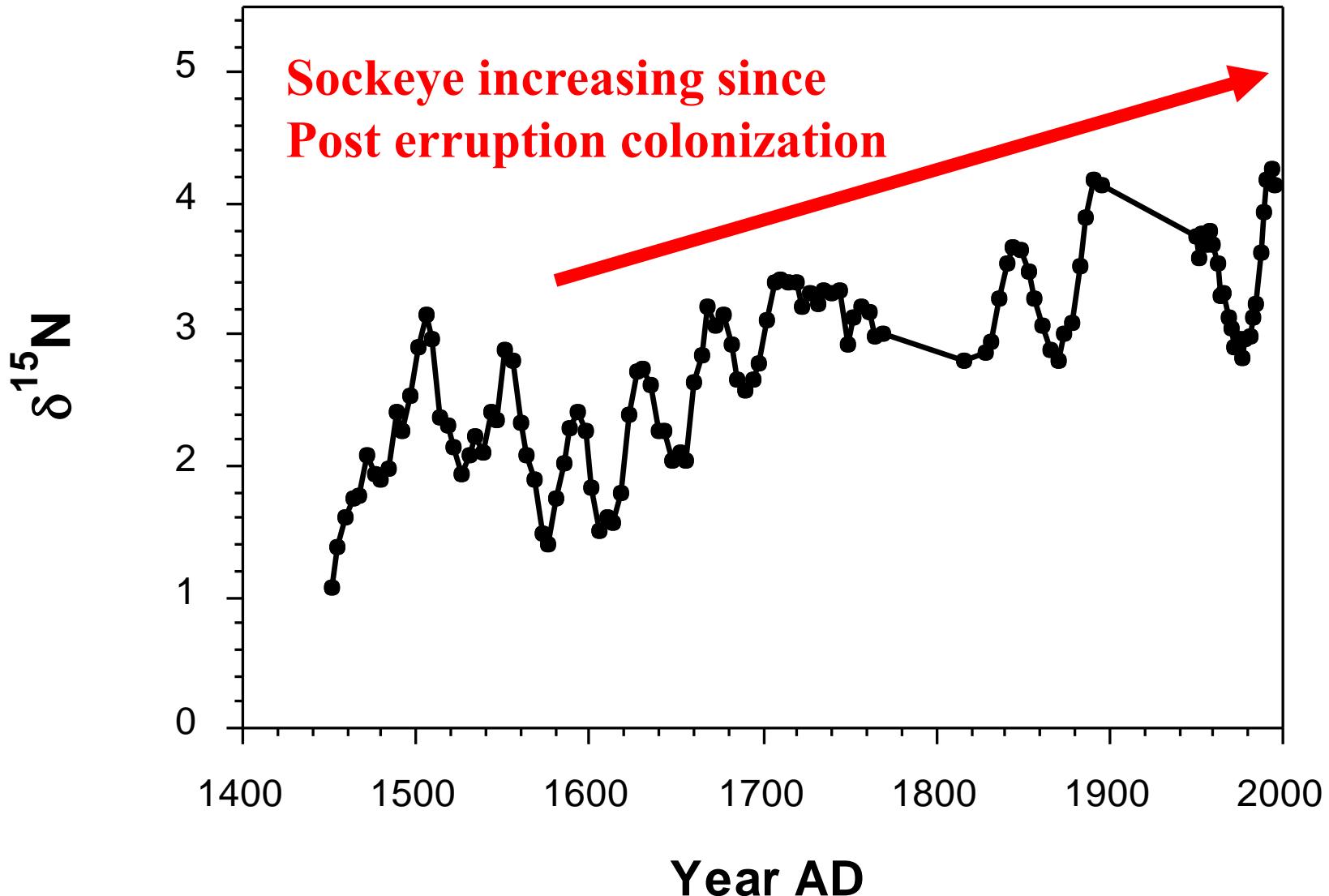
Nonviaunuk Lake



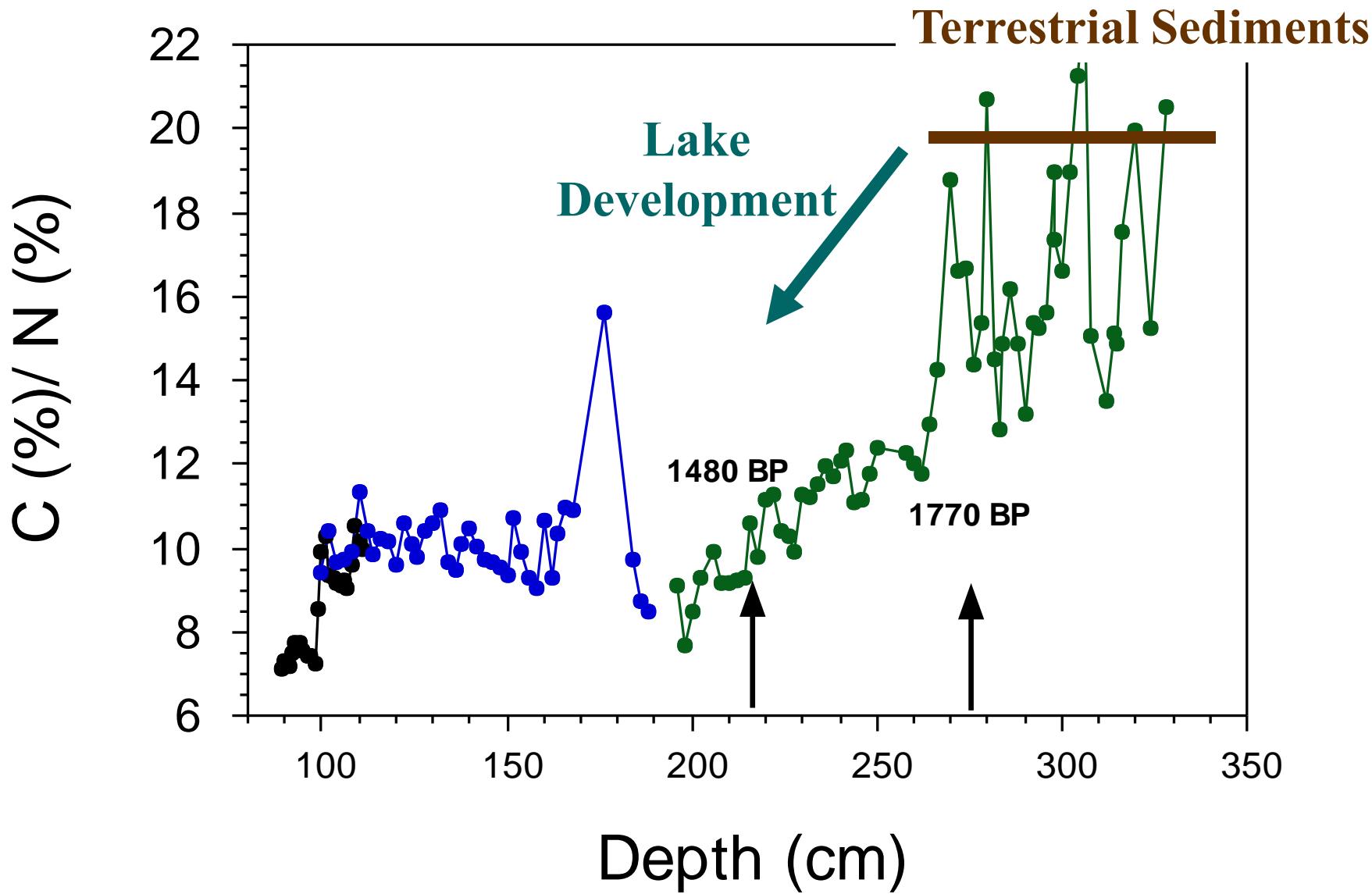
Surprise Lake

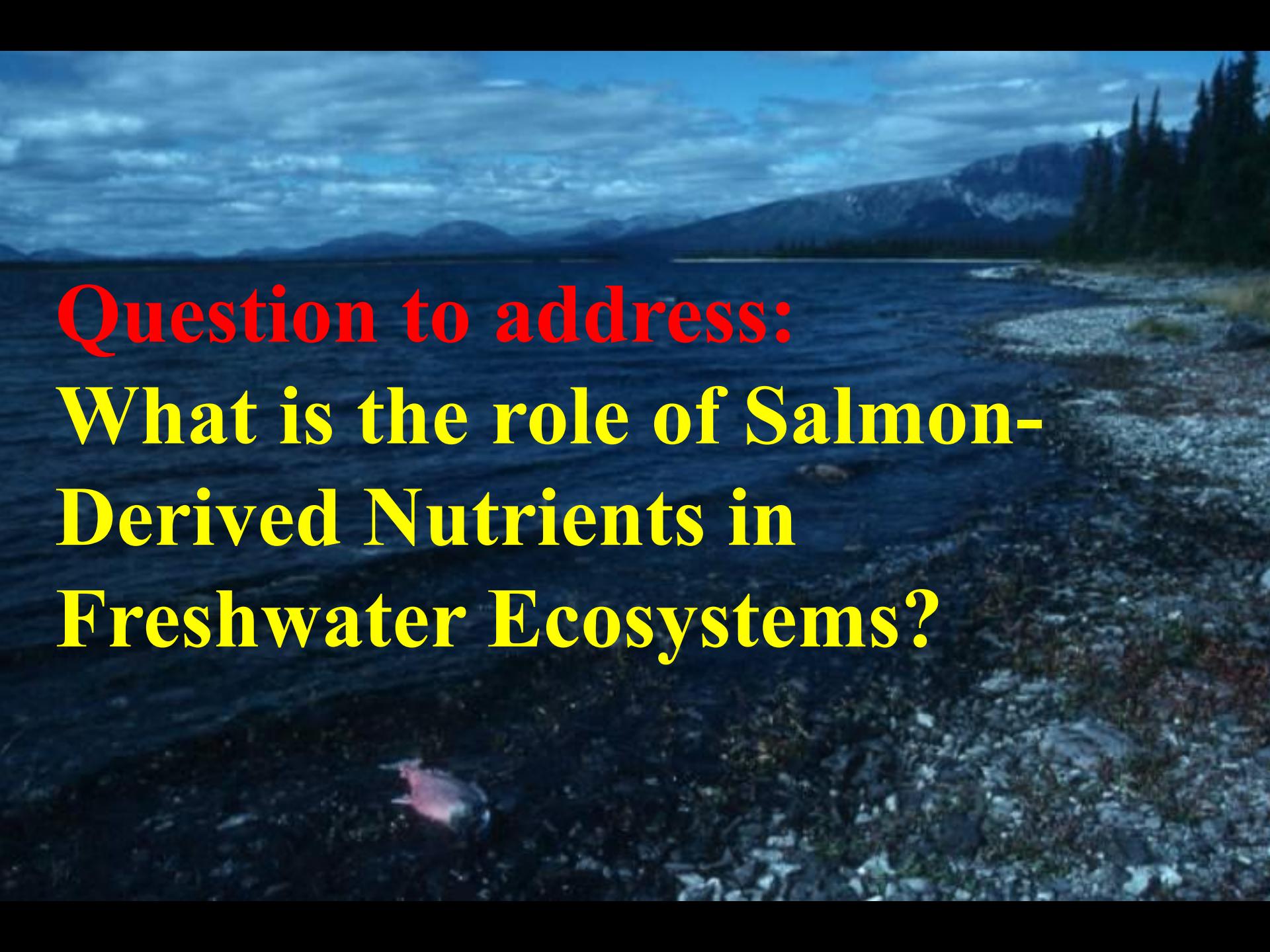


Surprise Lake



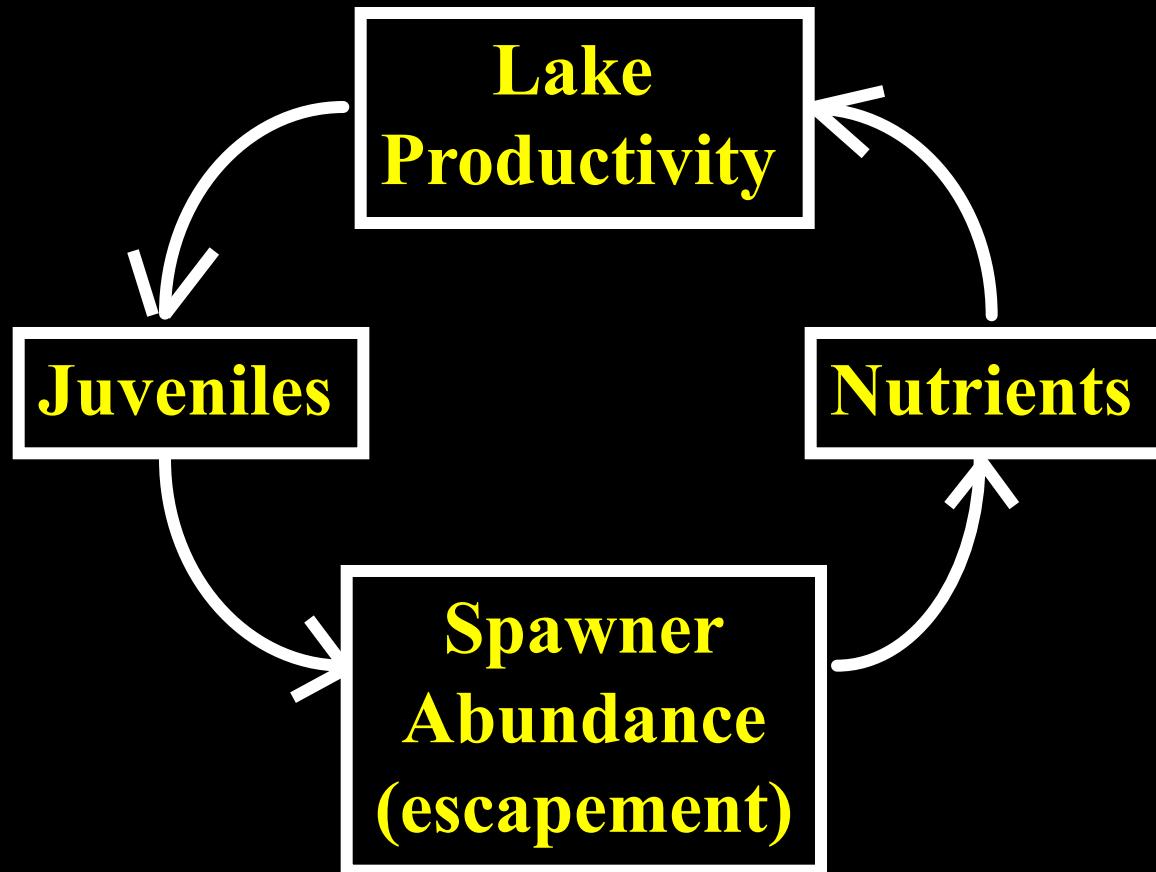
Meshik Lake: History of Formation



A scenic view of a lake with mountains in the background and a small island in the distance.

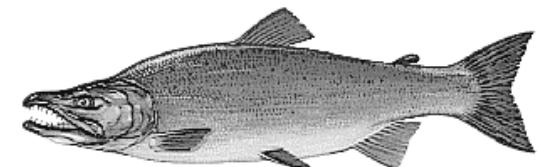
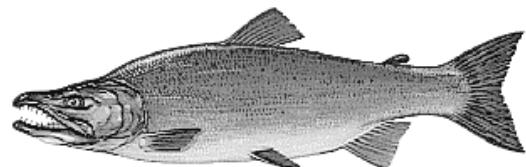
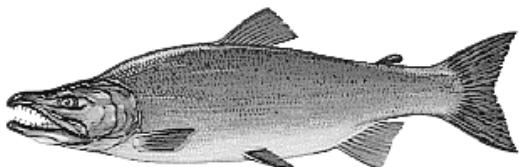
Question to address:
What is the role of Salmon-Derived Nutrients in Freshwater Ecosystems?

Salmon-Derived Nutrients - Productivity Feedback



Plans for Coming Year

- 1) Complete lab work on cores in hand.
- 2) Refine chronologies.
- 3) Assess $\delta^{15}\text{N}$ data in terms of salmon escapement.
- 4) Reconstruct lake paleoproductivity using multiple proxies.
- 5) Begin data interpretation and synthesis.
- 6) Conduct final fieldwork in summer 2005.

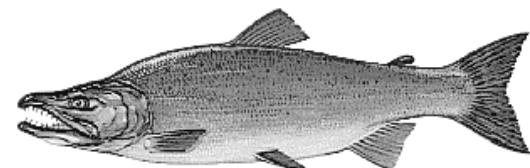
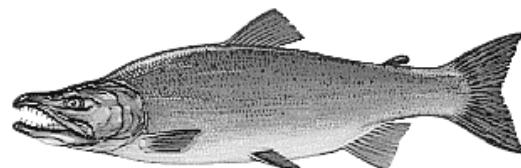
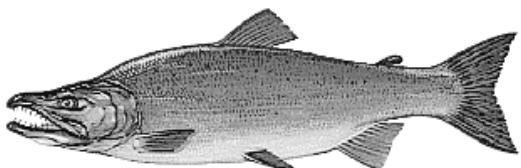


THANKS TO:

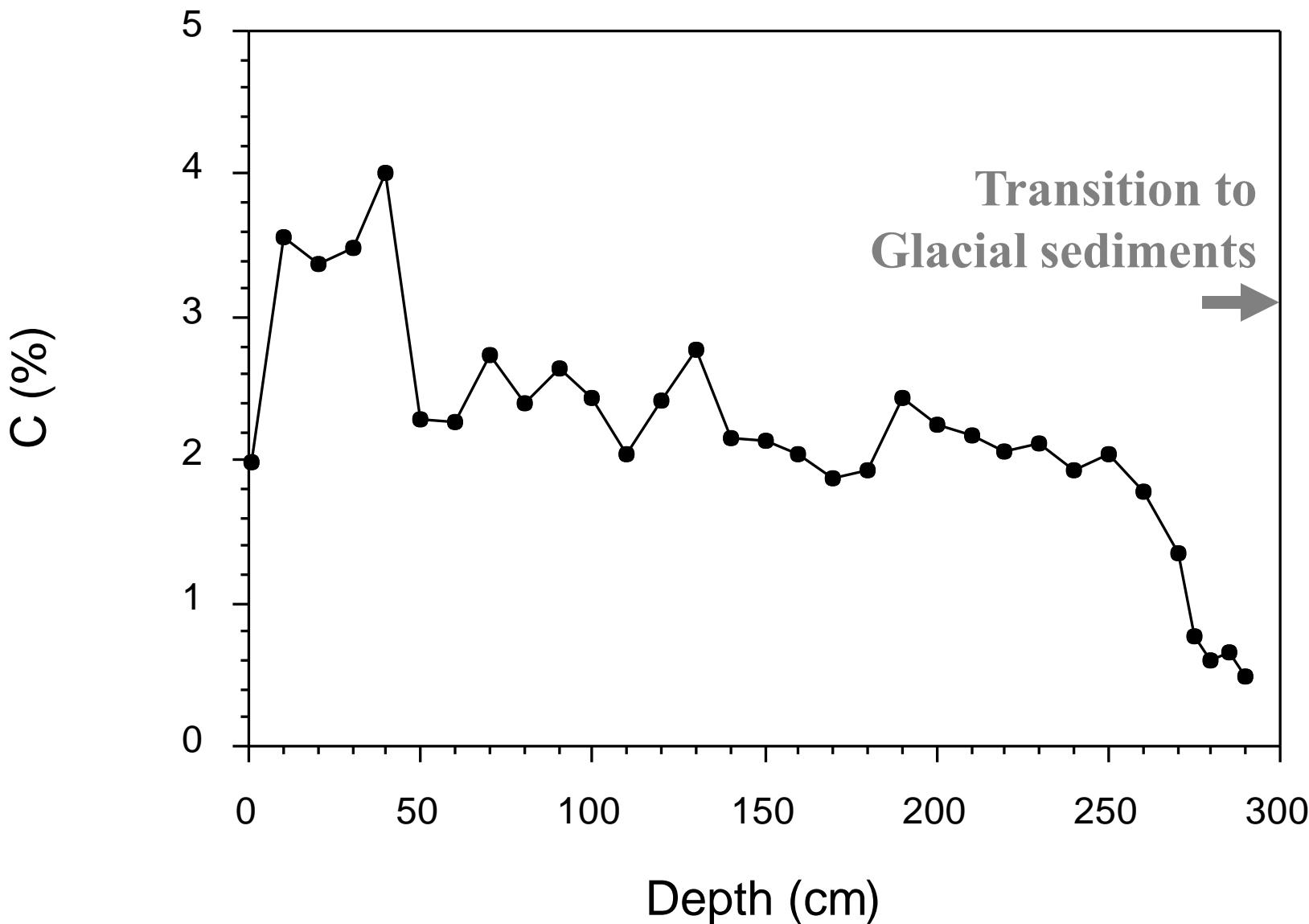
Fieldwork: E. Wang, C. Anderson, L. Bennett, T. Jones, Park Service staff in King Salmon.

Labwork: M. Odell, K. Streeter, T. Borland and S. Gaylor, T. Howe.

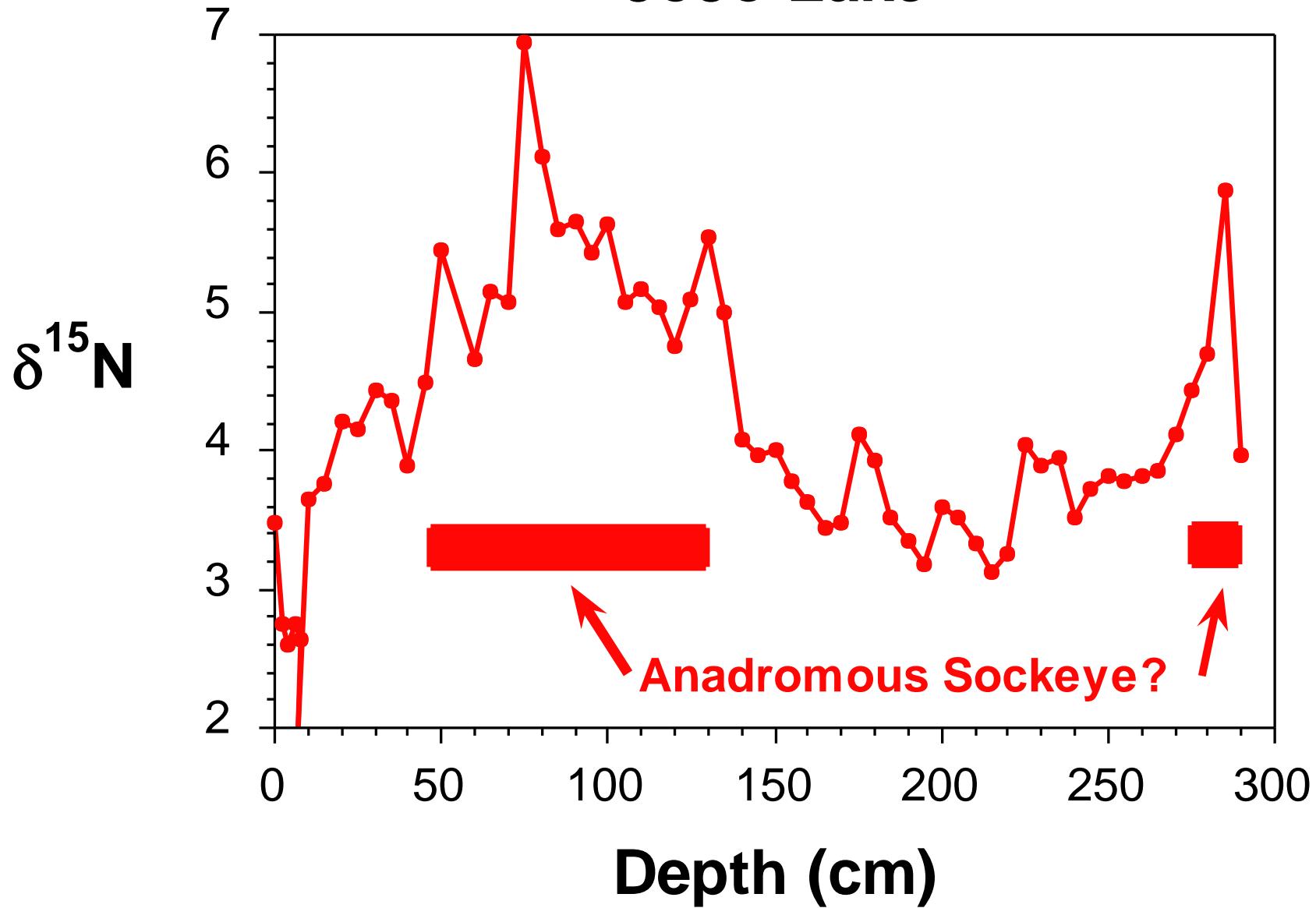
Funding and facilitation: L. Bennett, T. Hamon, Inventory and Monitoring Program of the National Park Service.



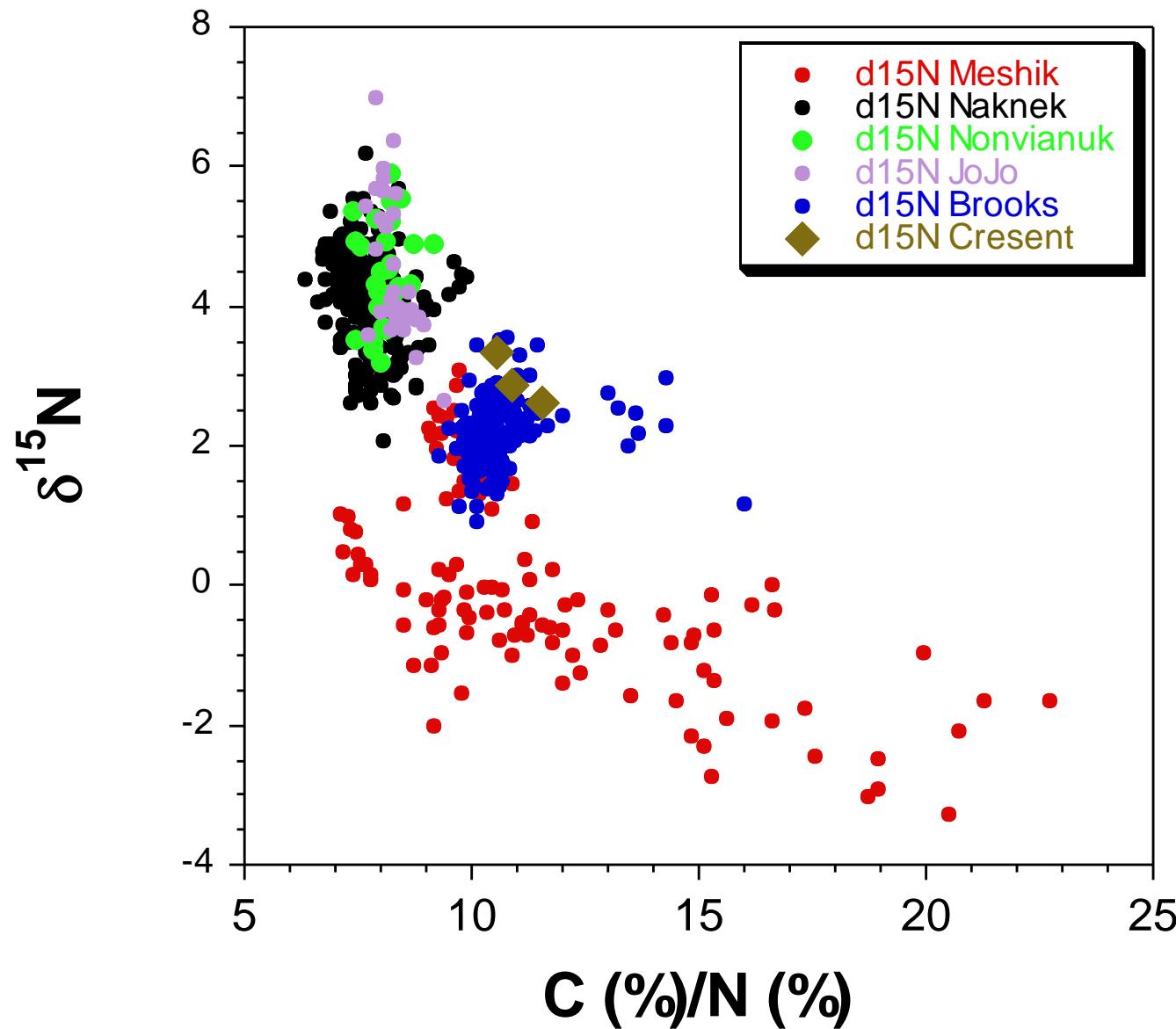
JoJo Lake: Geomorphic Change, Ocean Access and Colonization



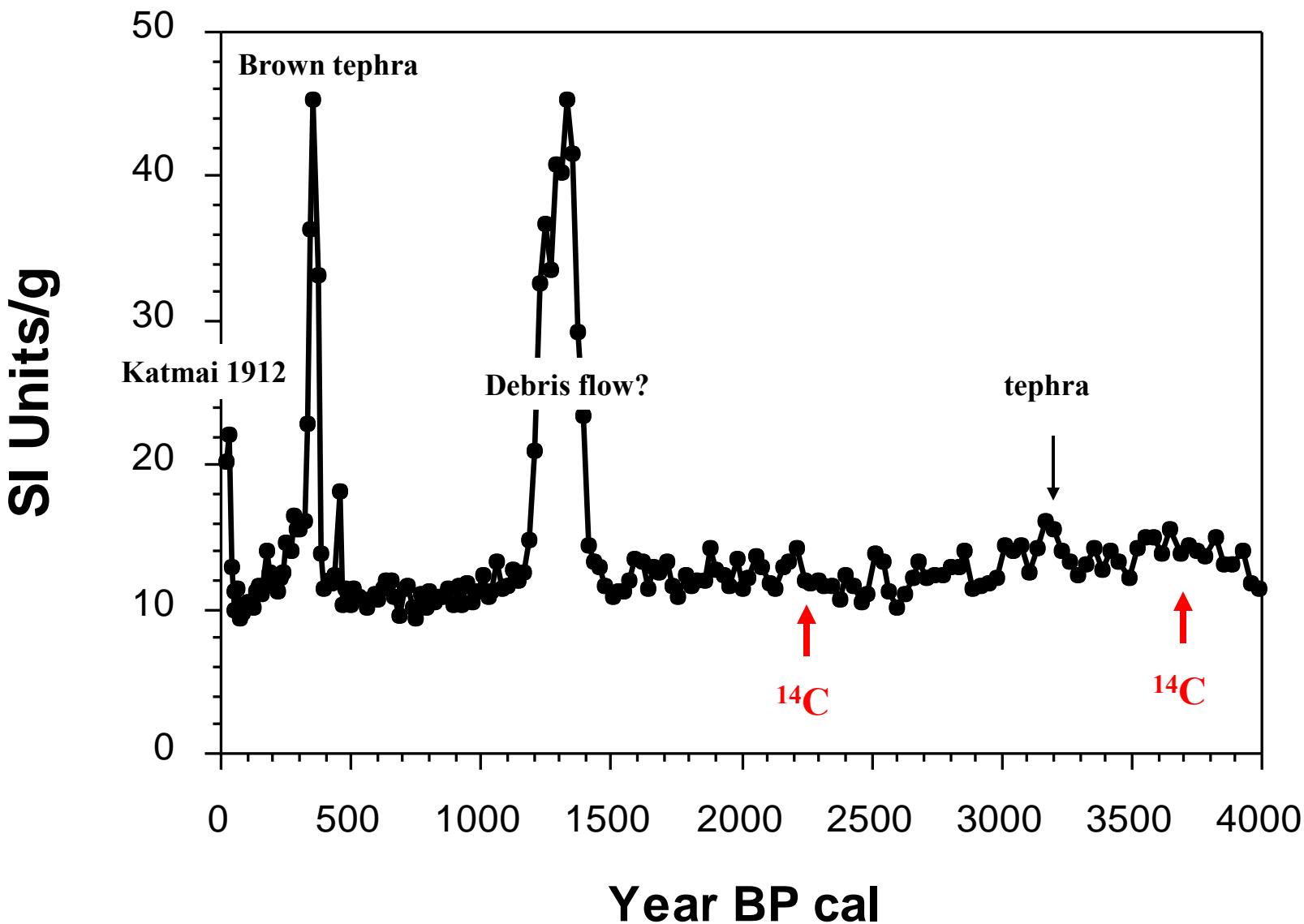
JoJo Lake



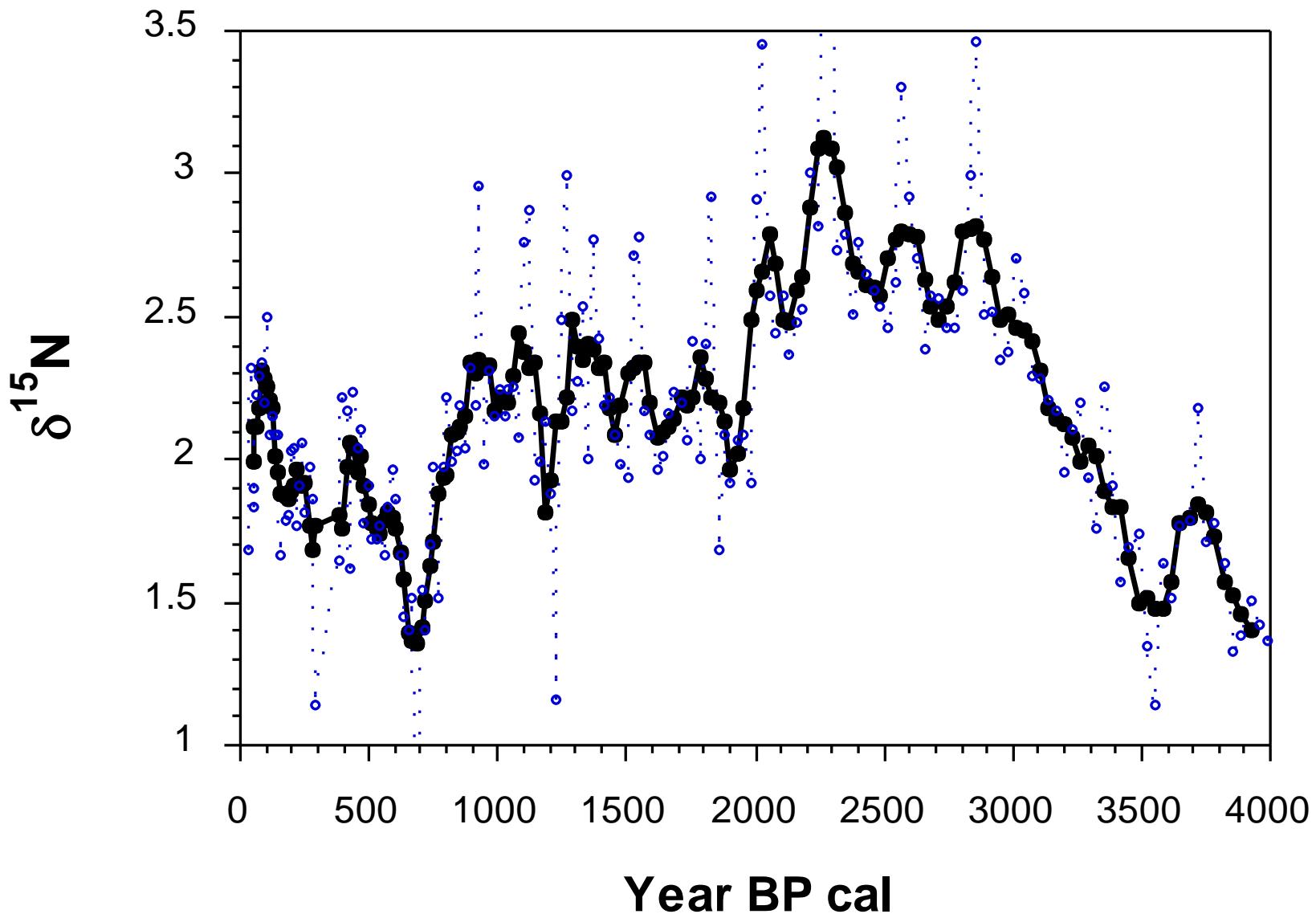
SWAN Salmon Lakes



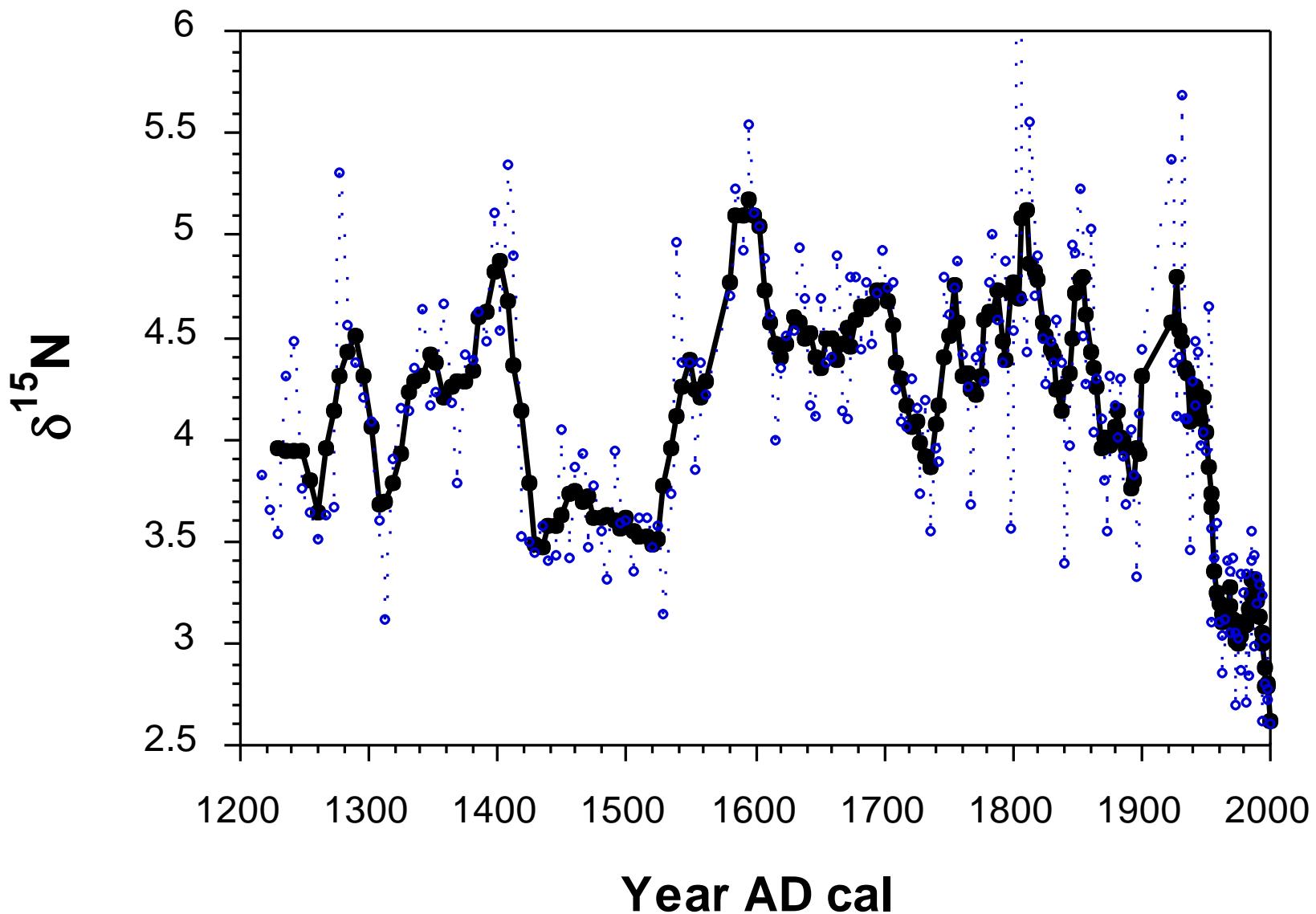
Brooks Lake



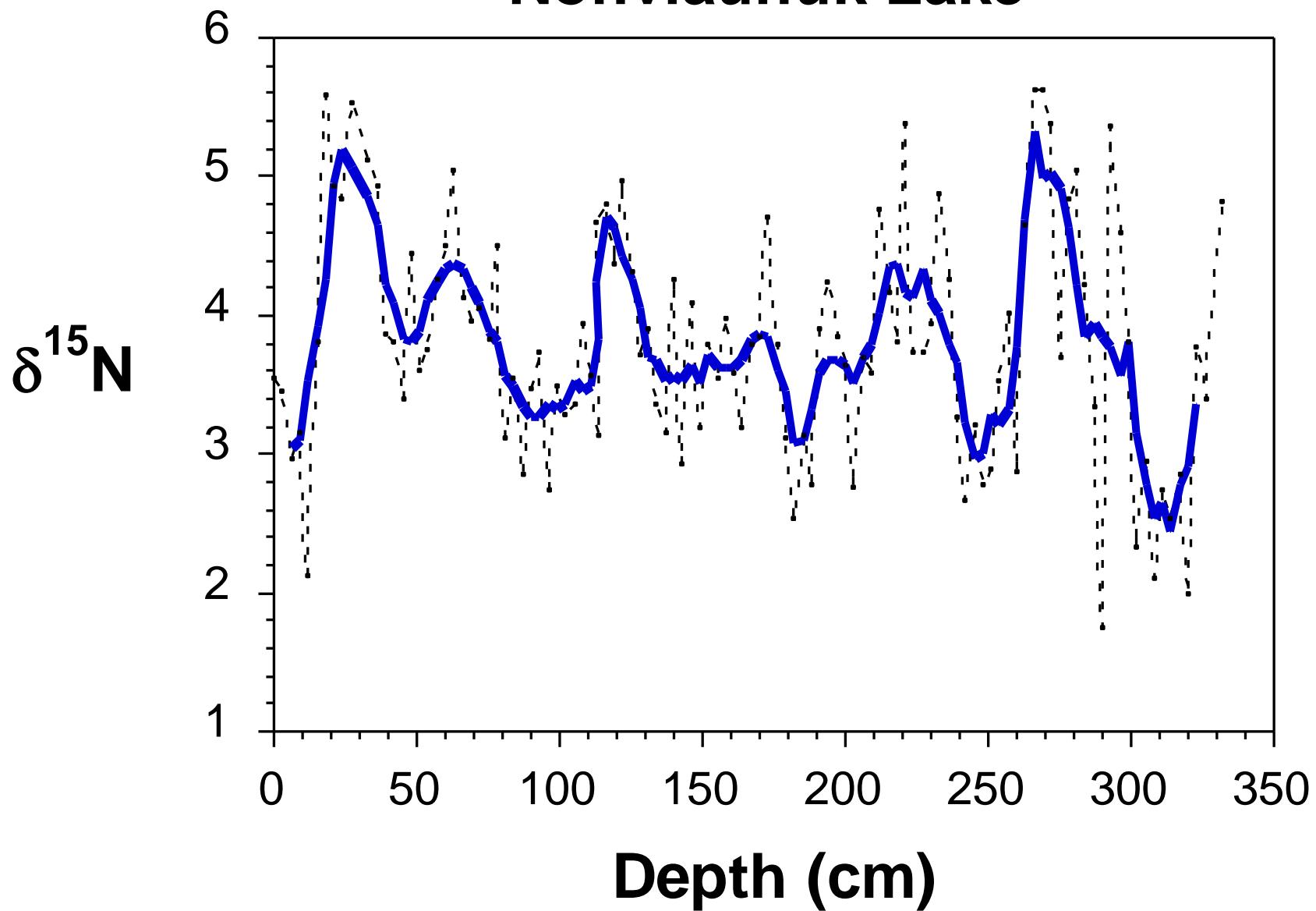
Brooks Lake



Naknek Lake



Nonviaunuk Lake



Meshik Lake

